

1. Subbasin Assessment – Watershed Characterization

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the CWA, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a “§303(d) list”) of impaired waters. Currently, this list must be published every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. (In common language, a TMDL also refers to the written document that contains the statement of loads and supporting analysis, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.)

This document addresses the water bodies in the Palouse River Subbasin that have been placed on Idaho's §303(d) list.

The overall purpose of this subbasin assessment (SBA) and TMDL is to characterize and document pollutant loads within the Palouse River Subbasin. The first portion of this document, the SBA, is partitioned into four major sections: watershed characterization, water quality concerns and status, pollutant source inventory, and a summary of past and present pollution control efforts (Sections 1 – 4). This information will then be used to develop a TMDL for each pollutant of concern for the Palouse River Subbasin (Section 5).

1.1 Introduction

In 1972, Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act. The goal of this act was to “restore and maintain the chemical, physical, and biological integrity of the Nation's waters” (Water Environment Federation 1987, p. 9). The act and the programs it has generated have changed over the years, as experience and perceptions of water quality have changed.

The CWA has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to insure “swimmable and fishable” conditions. This goal, along with a 1972 goal to restore and maintain chemical, physical, and biological integrity, relates water quality with more than just chemistry.

Background

The federal government, through the U.S. Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. The Department of Environmental Quality (DEQ) implements the CWA in Idaho, while the EPA oversees Idaho and certifies the fulfillment of CWA requirements and responsibilities.

Section 303 of the CWA requires DEQ to adopt water quality standards and to review those standards every three years (EPA must approve Idaho's water quality standards). Additionally, DEQ must monitor waters to identify those not meeting water quality standards. For those waters not meeting standards, DEQ must establish a TMDL for each pollutant impairing the waters. Further, the agency must set appropriate controls to restore water quality and allow the water bodies to meet their designated uses.

These requirements result in a list of impaired waters, called the "§303(d) list." This list describes water bodies not meeting water quality standards. Waters identified on this list require further analysis. A SBA and TMDL provide a summary of the water quality status and allowable TMDL for water bodies on the §303(d) list. The *Palouse River Tributaries Subbasin Assessment and TMDL* provides this summary for the currently listed waters in the Palouse River Subbasin.

The SBA section of this report (Sections 1 – 4) includes an evaluation and summary of the current water quality status, pollutant sources, and control actions in the Palouse River Subbasin to date. While this assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up to date and accurate. The TMDL is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (Water quality planning and management, 40 CFR 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

Some conditions that impair water quality do not receive TMDLs. The EPA does consider certain unnatural conditions, such as flow alteration, human-caused lack of flow, or habitat alteration, that are not the result of the discharge of a specific pollutants as "pollution." However, TMDLs are not required for water bodies impaired by pollution, but not by specific pollutants. A TMDL is only required when a pollutant can be identified and in some way quantified.

Idaho's Role

Idaho adopts water quality standards to protect public health and welfare, enhance the quality of water, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

The state may assign or designate beneficial uses for particular Idaho water bodies to support. These beneficial uses are identified in the Idaho water quality standards and include the following:

- Aquatic life support—cold water, seasonal cold water, warm water, salmonid spawning, modified

- Contact recreation—primary (swimming), secondary (boating)
- Water supply—domestic, agricultural, industrial
- Wildlife habitats
- Aesthetics

The Idaho legislature designates uses for water bodies. Industrial water supply, wildlife habitats, and aesthetics are designated beneficial uses for all water bodies in the state. If a water body is unclassified, then cold water aquatic life and primary contact recreation are used as additional default designated uses when water bodies are assessed.

A SBA entails analyzing and integrating multiple types of water body data, such as biological, physical/chemical, and landscape data to address several objectives:

- Determine the degree of designated beneficial use support of the water body (i.e., attaining or not attaining water quality standards).
- Determine the degree of achievement of biological integrity.
- Compile descriptive information about the water body, particularly the identity and location of pollutant sources.
- Determine the causes and extent of the impairment when water bodies are not attaining water quality standards.

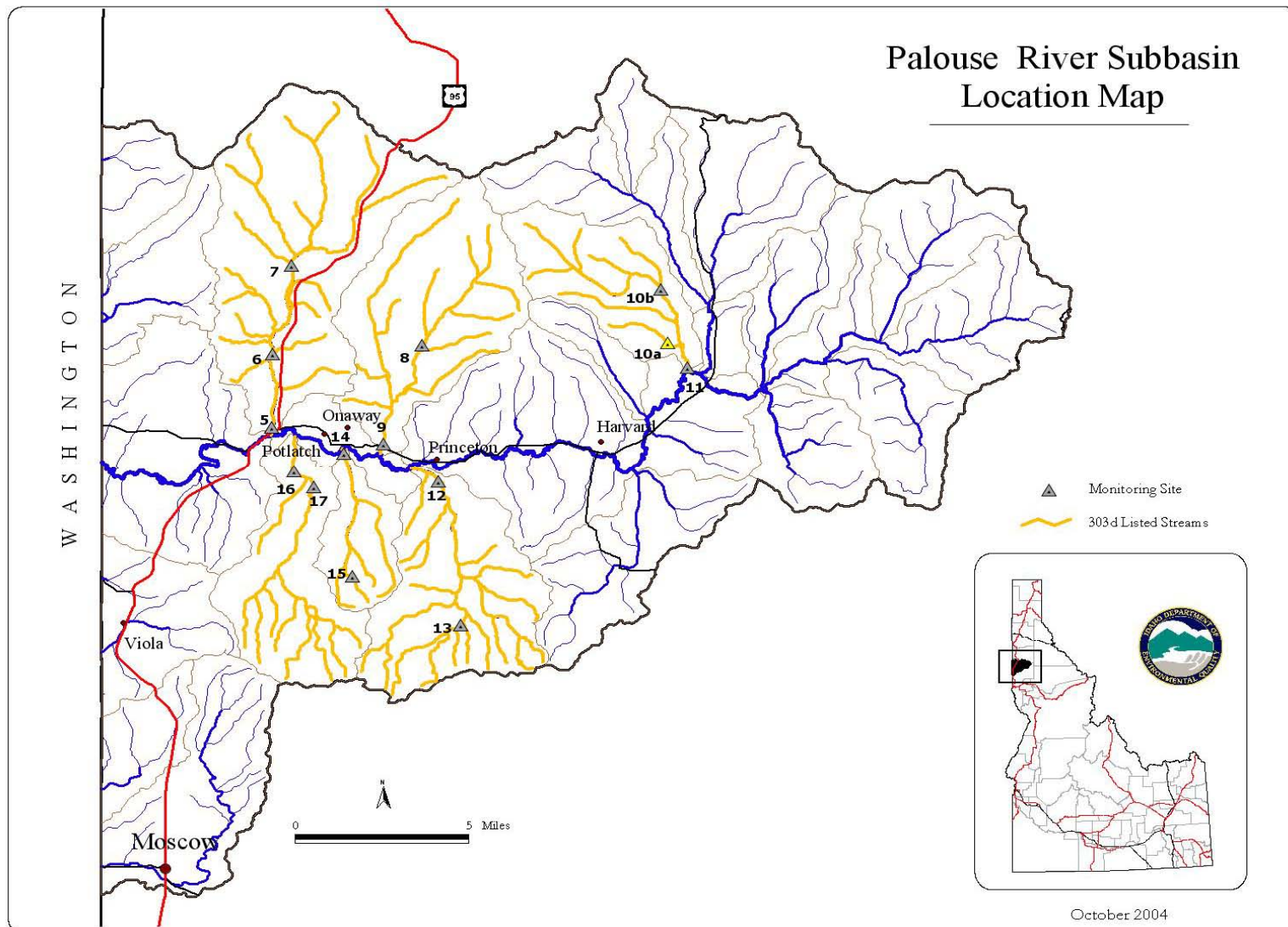
1.2 Physical and Biological Characteristics

In this section, the physical, biological, and cultural characteristics of the Palouse River Subbasin will be characterized and described. The data presented in this characterization is pertinent to issues affecting water quality in the basin and in each §303(d)-listed subwatershed. Map 1-1 shows the general geographical location of the Palouse River Subbasin and the location of the §303(d) water bodies. The headwaters of the Palouse River originate in the Hoodoo Mountains of the St. Joe National Forest. The Palouse River and most of its tributaries originate in forested, mountainous terrain and flow downstream into the lower gradient rolling hill terrain of the Palouse, which is dominated by agriculture. The Palouse River flows into the State of Washington about six miles west of the town of Potlatch. Bordering the Palouse River Subbasin on the north and to the northeast is the St. Maries River drainage; to the east and southeast is the Potlatch River drainage; and to the south is the South Fork Palouse River drainage. The Palouse River Subbasin is approximately 407.25 square miles (260,641 acres) and is located primarily in Latah County. There are no anadromous fish in the Palouse River as Palouse River Falls, located in the State of Washington, blocks fish migration.

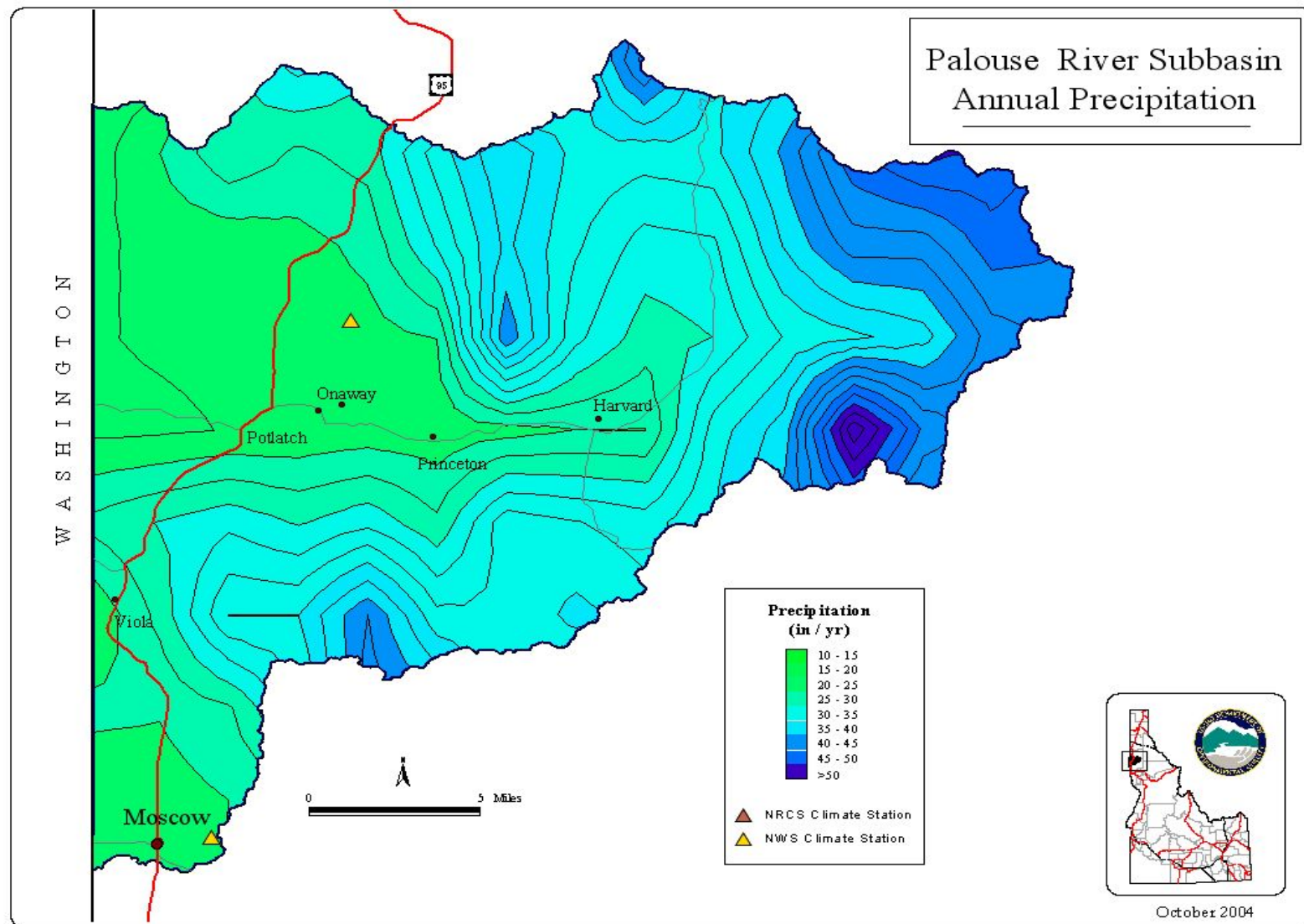
Climate

North Central Idaho is dominated by maritime air masses and prevailing westerly winds. During the fall, winter, and spring months, cyclonic storms move towards the east and produce low-intensity, long-duration precipitation, which accounts for most of the annual precipitation. Prolonged gentle rains and deep snow accumulations at higher elevations with fog, cloudiness, and high humidity characterize the basin in the fall, winter, and spring months. Winter temperatures are often 15° F to 25° F warmer than the continental locations

of the same latitude. A seasonal snow pack generally covers elevations above 4,000 feet from December to May. The climate during the summer months is influenced by high-pressure stationary systems. These systems sometimes produce high-intensity electrical storms, which cause frequent wildfires, especially during exceptionally hot and dry summers. Precipitation isohyets (bands) for the Palouse River Subbasin are shown on Map 1-2.



Map 1-1. General Location



Map 1-2. Annual Precipitation Isohyetals Amount for the Palouse River Subbasin

Climatic data was collected for this report from a total of five locations and is summarized in Table 1-1. In general, as elevation increases, so does the amount of precipitation, with portions of that in snowfall. There is also a considerable temperature difference based on elevation. For example, the City of Moscow (elevation 2,660 ft) averages over 25 days per year where the temperature exceeds 90° F, while Moscow Mountain (elevation 4,700 ft) averages 3 days per year where temperatures exceed 90° F. In the summer months, the average temperatures are about 10-15° F warmer at the lower elevations than at the summit and butte locations. Hot summer temperatures are common at the middle to lower elevations in the Palouse River Subbasin and are the major factor influencing water temperatures. Air temperatures at the middle to lower elevations will exceed 90° F anywhere from 20% to 70% of the time in the July and August. This fact should be considered when measuring thermal heat loads to the water bodies. Table B-1(Appendix B) displays the average monthly means, maximums, and minimums for temperatures, as well as the average monthly precipitation for each station.

Table 1-1. Summary of climate data.

Station Name	Type	Elevation (ft)	Period of Record	Mean Annual Temp (°F)	Mean Annual Precipitation (inches)	# of Days > 90 °F per year
Moscow, U of I	ISCS ¹	2660	1/1/71-12/31/00	47.3	27.4	25.4
Pullman, WA	WRCS ²	2550	1/1/71-12/31/00	47.4	21.0	27.6
Potlatch, ID	ISCS	2600	1/1/71-12/31/00	45.5	26.6	11.2
Moscow Mountain, ID	NRCS ³	4700	1/1/01-12/31/02	41.5	40.1	3.0
Sherwin, ID	NRCS	3200	1/1/71-12/31/00	ND	42.2	ND

¹ ISCS = Idaho State Climate Services

² WRCS = Western Region Climate Center

³ NRCS = Natural Resource Conservation Service

Hydrology

The Palouse River flows approximately 29 miles from its headwaters near the Hoodoo Mountains to the Idaho/Washington state line. In the State of Washington, the Palouse River flows approximately another 110 miles before reaching the Columbia River. The United States Geological Service has kept a gauge on the Palouse River located two miles west of the town of Potlatch. The period of record is from October 1914 through September 1919, and from December 1966 through the current year. The median daily stream flow based on 39 years of record from this gage is displayed in Figure 1-1.

The streams in the basin have a pattern of low flows during the late summer and early fall months and high flows in the spring and early summer months. The peak discharge is typically in late March, April, or early May. A peak discharge of 14,600 cubic feet per second (cfs) was recorded on the Palouse River on February 9, 1996, while a minimum flow of 0.09 cfs was recorded on September 24, 1973. Several of §303(d)-listed streams in the Palouse River Subbasin are intermittent from their source to the mouth; some §303(d)-listed

streams begin as perennial streams and then become intermittent; others completely perennial streams.

In general, the hydrology of the streams in the upper Palouse River Subbasin are controlled by snowmelt and ground water while the hydrology of the streams running through agricultural land in the lower Palouse River Subbasin are controlled by snowmelt and precipitation events. Over the past century it is likely that the hydrology of the Palouse River has changed due to changes in land use. For example, Deep Creek, once named for its deep perennial pools, is now classified as an intermittent stream. Historical information classifies Deep Creek as a perennial stream. A USGS quad map dated 1955 displays Deep Creek as a perennial stream while the current USGS quad map displays Deep Creek as intermittent. Many intermittent streams in the Palouse are probably similar. The most current USGS Quad maps classify Deep and Rock Creeks as intermittent streams, and Big, Flannigan, Gold and Hatter Creeks as perennial streams.

The data collected for this TMDL about the §303(d)-listed streams correspond to USGS information regarding stream classification. Flow data for each §303(d)-listed stream from November 2001 through November 2002 are displayed below in Figures 1-2 through 1-7. The peak discharges for each stream are not measured values. They are discharge estimates.

When the discharge becomes very large, it becomes physically impossible to enter the streams for a measurement. It is also interesting to note that Rock and Deep Creeks went completely dry in the summer of 2002, while Big Creek, Flannigan Creek, Gold Creek and Hatter Creek had some water flowing in them during the entire year.

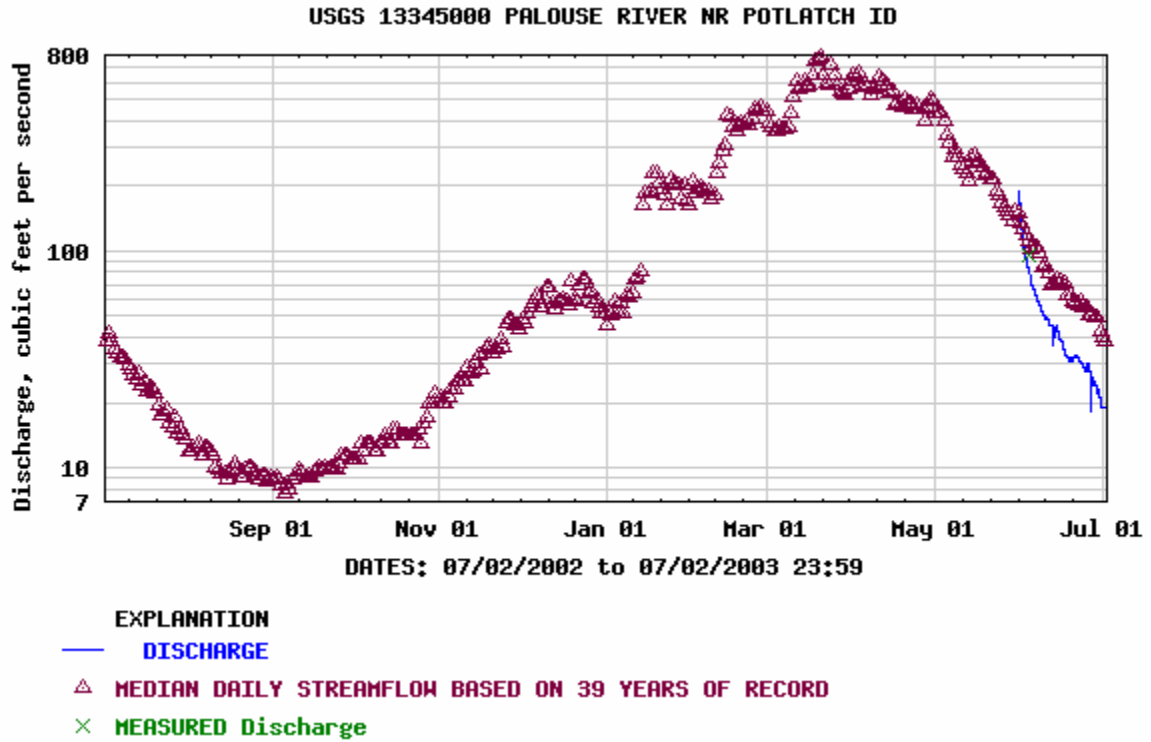


Figure 1-1. Historical Median Daily Stream flow Palouse River Discharge at USGS Gauge Site

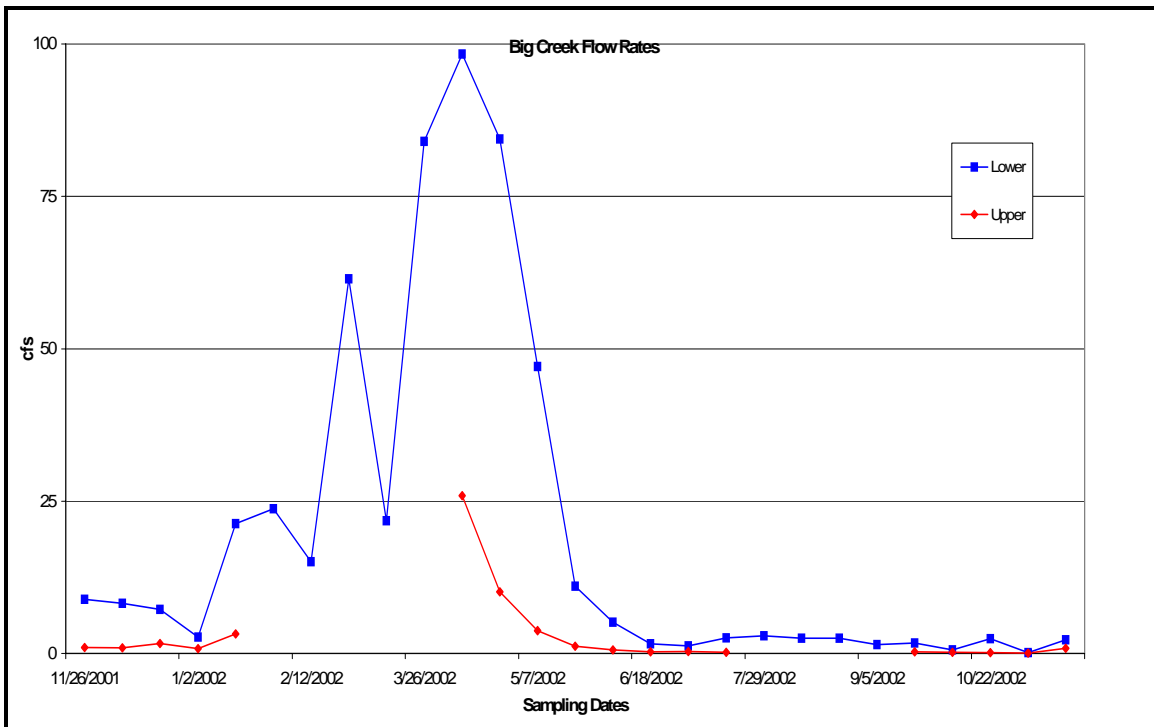
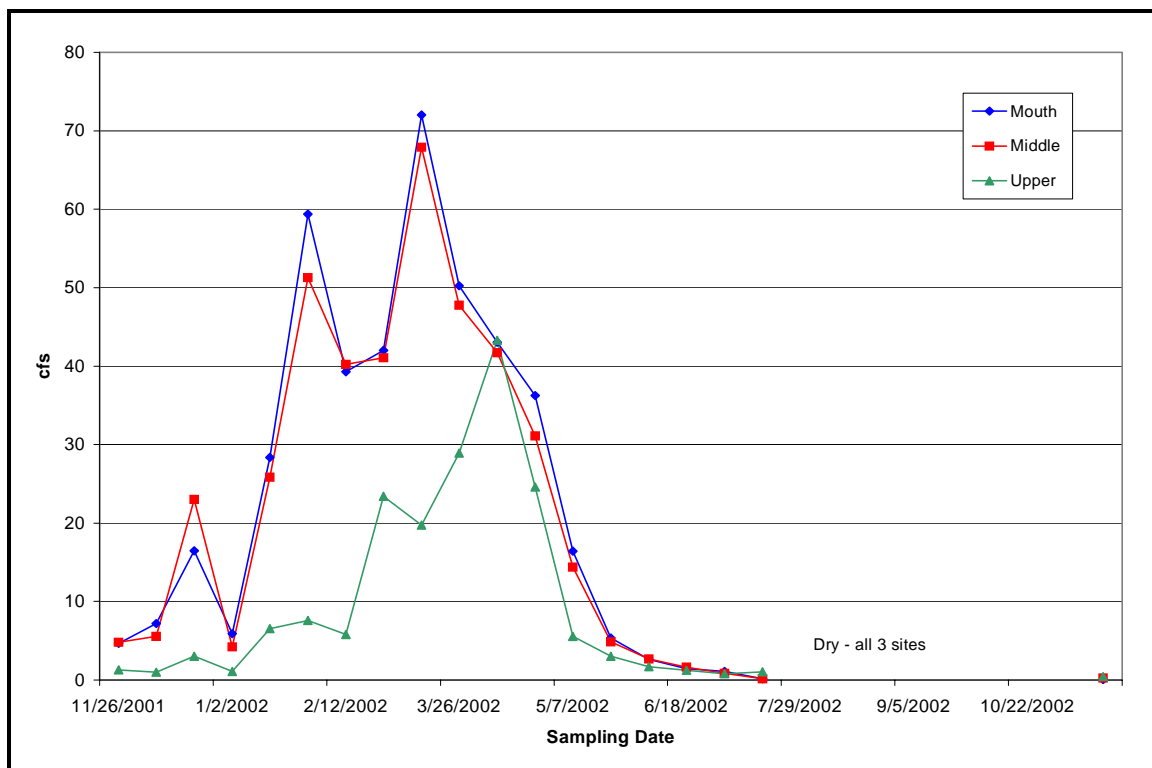
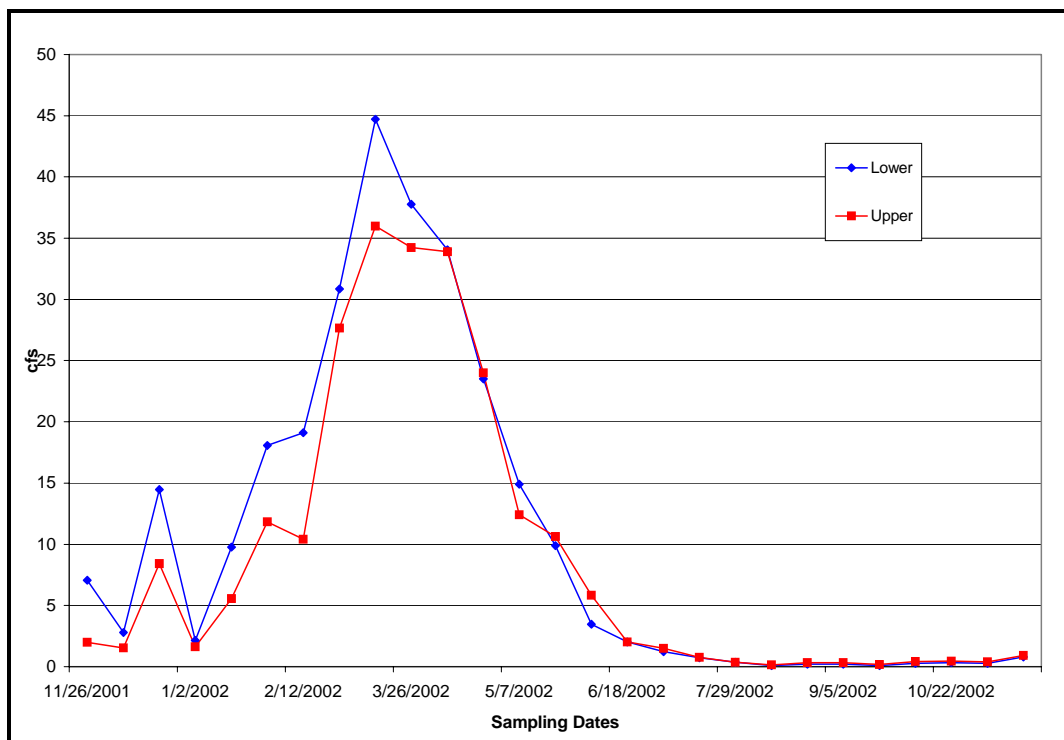


Figure 1-2. Big Creek Flow Rates

**Figure 1-3. Deep Creek Flow Rates****Figure 1-4. Flannigan Creek Flow Rates**

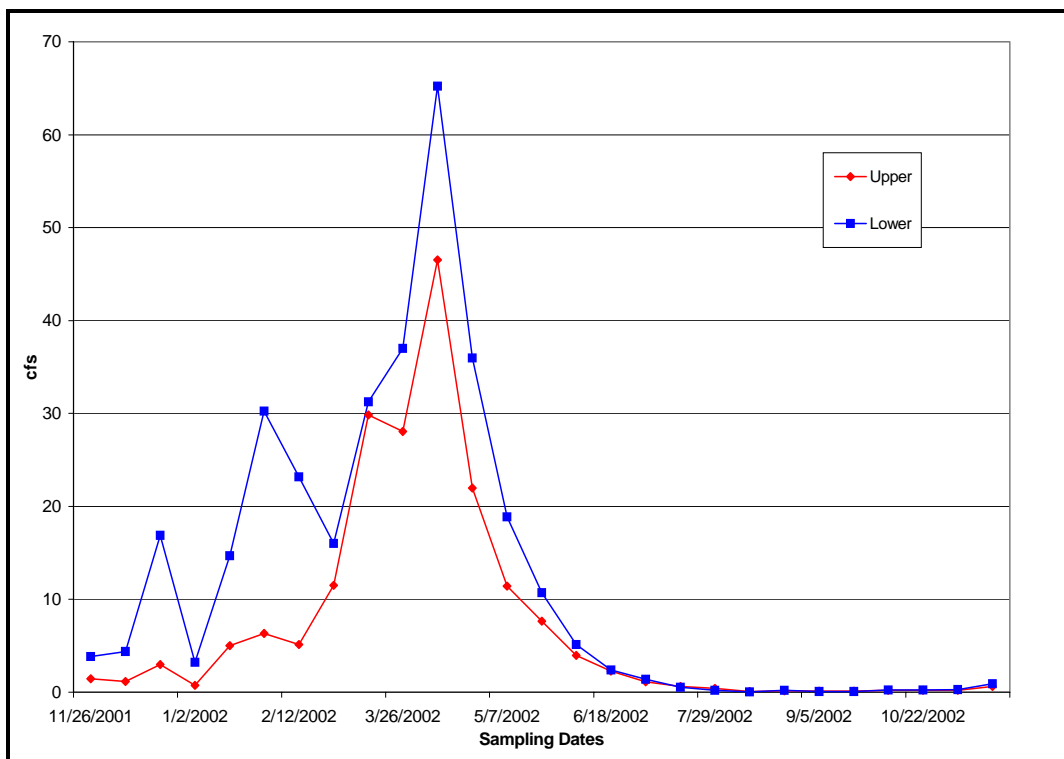


Figure 1-5. Gold Creek Flow Rates

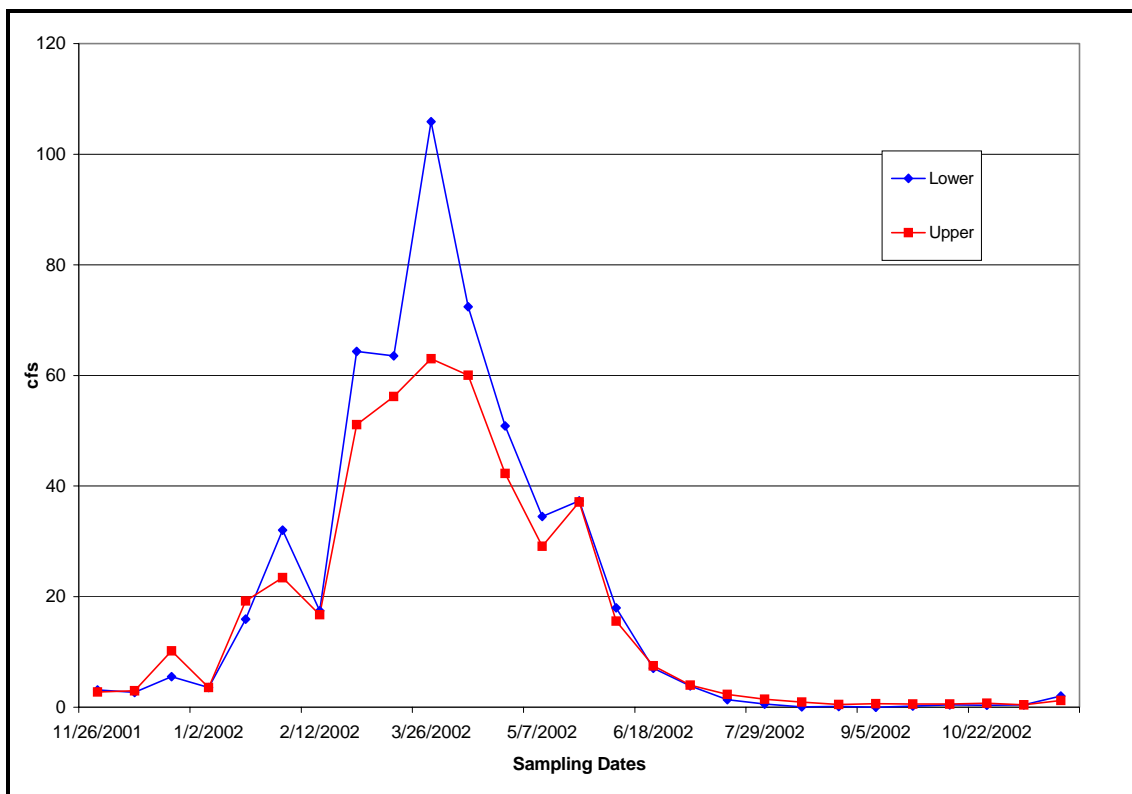


Figure 1-6. Hatter Creek Flow Rates

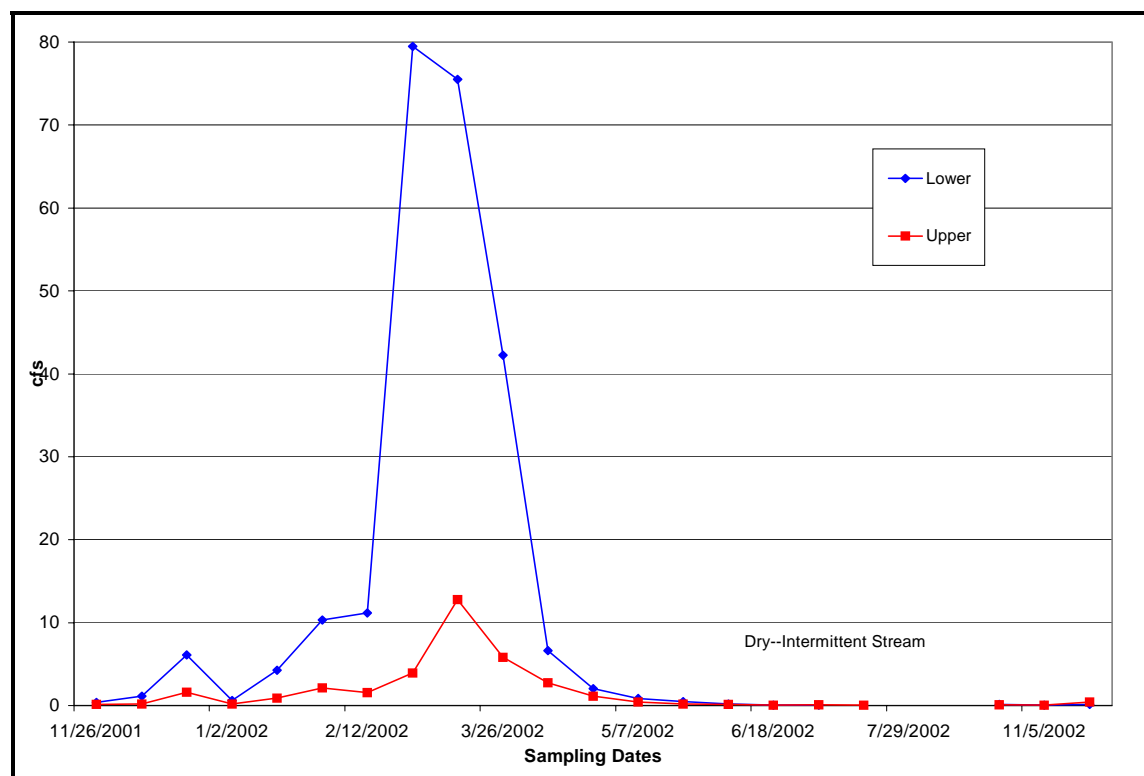


Figure 1-7. WF Rock Creek Flow Rates

Topography, Geology and Soils

In the Palouse River Subbasin, elevations range from 2,453 ft at the state line to 5,334 ft on Bald Mountain in the Hoodoo Mountain range. Most elevations are within 2,500 to 3,500 feet. The north slopes are of moderately to steeply rolling hills, while the south slopes are more moderate. Map 1-3 displays the topographic relief of the Palouse River Subbasin.

The general surface geology is represented on Map 1-4. Several landforms compromise the topography of the Palouse River Subbasin. Most the Palouse River Subbasin is covered by rolling hills (Palouse Loess), which were created by wind deposition. The hills are anywhere from 100- to 300-feet thick and form some of the most agriculturally productive soils in the world. These rich, silty-loam soils are the main reason the Palouse area was settled and the land converted from prairie grasslands into dryland agriculture.

The high elevations in the middle portions of the Palouse River Subbasin are weathered granitic features like Moscow Mountain and Gold Hill. The highest elevations to the north and east, like the Hoodoo Mountain range and Bald Mountain, are metasedimentary rocks of the Belt Series. Basalt outcroppings appear underneath the Palouse Loess in the western portions of the watershed. In the valley bottoms along the Palouse River and the main tributaries, coarse textured alluvium sediment deposition is present.

The soils derived from metasedimentary rocks generally weather to finer textured soils with varying amounts of coarse fragments. Granitics weather rapidly to grus, which are sandy and excessively well-drained in composition. Basalt rock has a tendency to weather into large

cobble-size material. The Palouse Loess erodes fine silt, which is relatively easily transported into waterways. The fine silt from the Palouse Loess under cultivation practices is the largest source of sediment in the streams of the Palouse River Subbasin.

Erosion

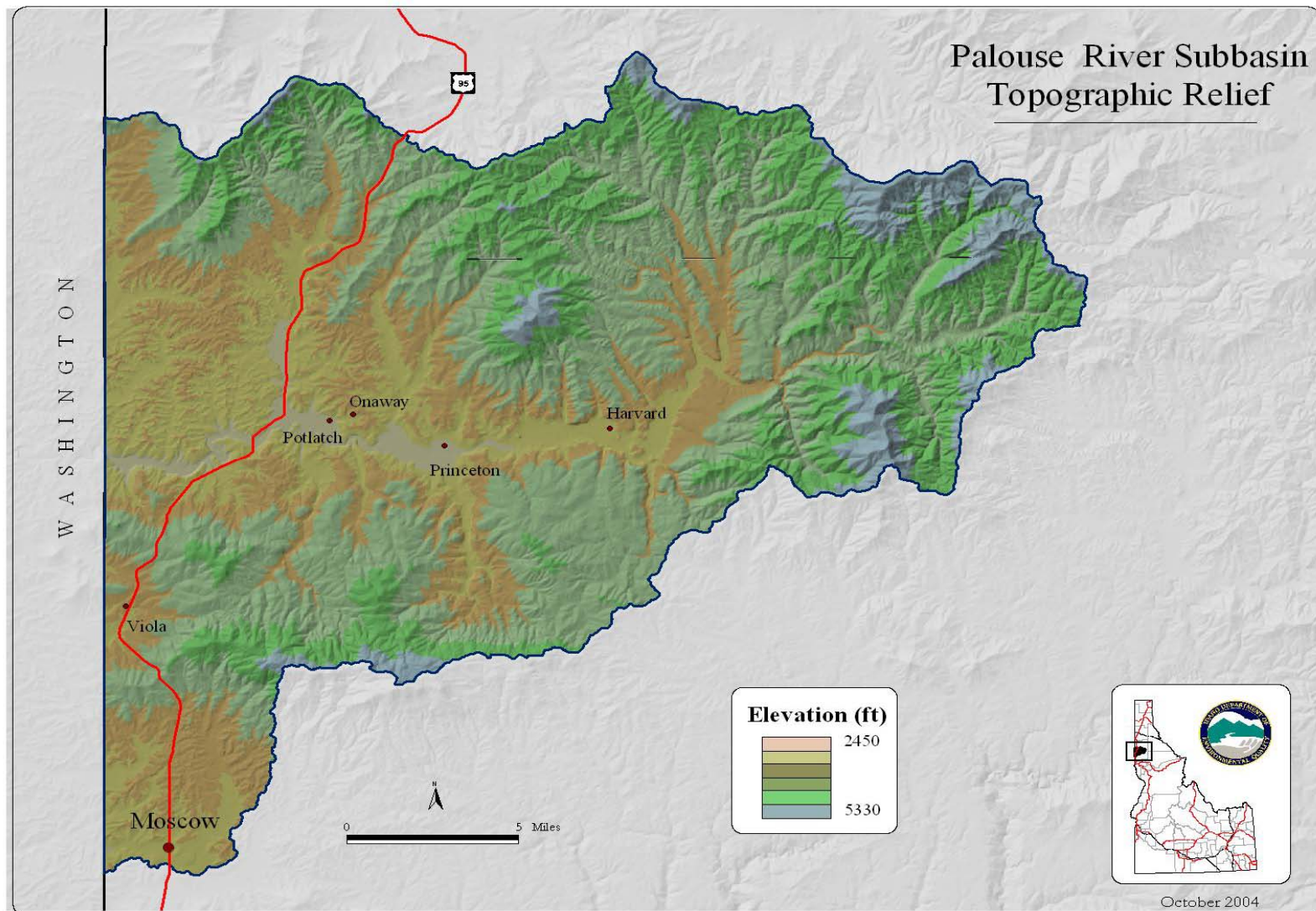
According to information collected by the USGS, it appears that sediment runoff into the streams has decreased since the 1960s and 1970s. Suspended sediment levels in the Palouse River in Hooper, Washington, show a decreasing trend as in Figure 1-8 (Ebbert and Roe, 1998). Other information from the USGS displays that the highest concentration of suspended sediments occur during storm events. The same conclusion can be drawn from the data that DEQ collected monitoring November 2001 through November 2002.

Another trend that was observed was the increase in suspended sediment amounts within the stream where different land-use practices exist. Table 1-3 shows the differences in suspended sediment and nephelometric turbidity unit (NTU) levels between agricultural lands and forestlands based on the data collected for this report from November 2001 through November 2002. In general sedimentation levels detected in the 303(d) listed streams adjacent to agricultural lands are higher than those in the 303(d) listed streams adjacent to forest lands.

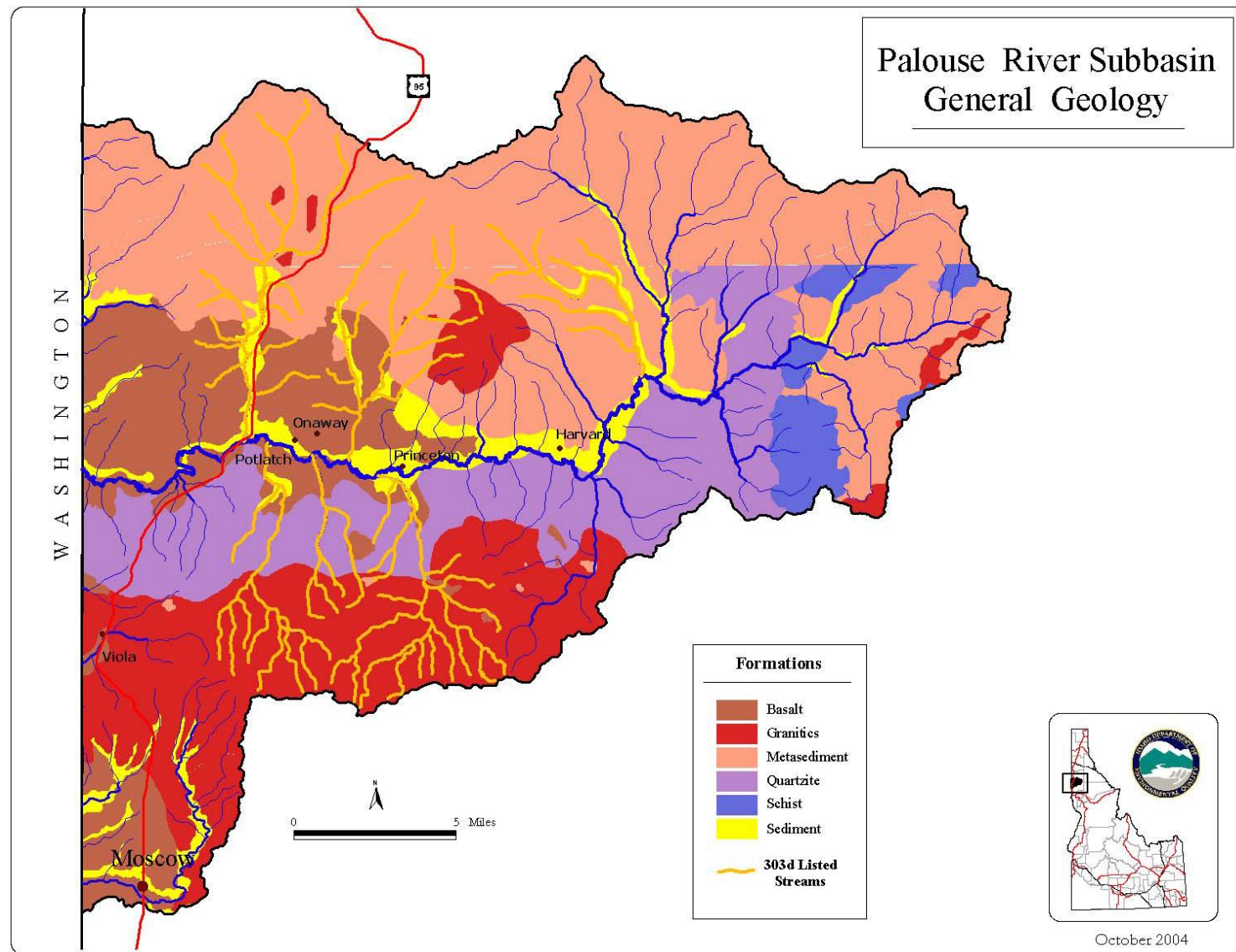
Two exceptions to the observed sediment situation are Hatter Creek and Rock Creek, which both have a limited amount of tilled agricultural land. The main agricultural crop within these two watersheds is hay. Hatter Creek is also significantly impacted by a road paralleling a majority of the main stem, which has significant erosion from cut and fill slopes, altering the ratio between the forest lands and agricultural lands. The upper site in Rock Creek is close to a culvert crossing, which is a significant sediment source as the downstream side of the culvert is eroding into Rock Creek.

In general, a greater amount of sediment will reach stream channels when the soil surface is disturbed. In the Palouse River Subbasin, the agricultural lands are generally more disturbed than forestlands. This trend may be represented in the data that was collected for this report as sediment was measured in the lower sections of the streams.

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Map 1-3. Topographic Relief of the Palouse River Subbasin.



Map 1-4. General Geology Map.

Background erosion rates

Erosion in some areas of the Palouse River Subbasin is enormous and the Palouse has been called one of the most erosive areas in the United States (Beus, 1990). The United States Department of Agriculture (USDA) estimated that from 1939 through 1977, the average annual rate of soil erosion in the Palouse was 14 tons/acre on cultivated cropland. Although this process is the major contributor of sediment to the streams, this is not the amount that reaches a water body, just the amount displaced from the slopes. In the 1930s and '40s, as much as 100 tons of soil could be washed from an acre in one storm (Sorensen, 2002). Some researchers believe that 40% of the soils have been lost to erosion (Pimentel and others, 1995). It takes 300 to 1,000 years to create one inch of topsoil, but the average loss on the Palouse since the 1920's is one inch per twelve years (Soule and Piper, 1992).

Another way to look at background soil erosion rates on agricultural lands is to run the Revised Universal Soil Loss Equation (RUSLE) model using a vegetation community that resembles natural vegetation. Table 1-2 displays background erosion rates that were calculated by RUSLE. These values represent the amount of sediment delivered to a stream and were used to determine the background ratio and the RUSLE supplemental sediment data in Appendix D.

Table 1-2. Sediment background numbers

Watershed	Size (acres)	Size (mile²)	Amount (tons/acre/yr)	Amount (tons/mile²/yr)	Amount (tons/yr)
Big	10300.72	16.09	0.11	72.96	1174.28
Deep	27315.56	42.68	0.09	58.05	2477.52
Flannigan	12246.82	19.14	0.12	79.55	1522.28
Gold	18069.78	28.23	0.11	71.17	2009.36
Hatter	16163.44	25.26	0.10	66.18	1671.30
Rock	5174.76	8.09	0.12	74.50	602.34

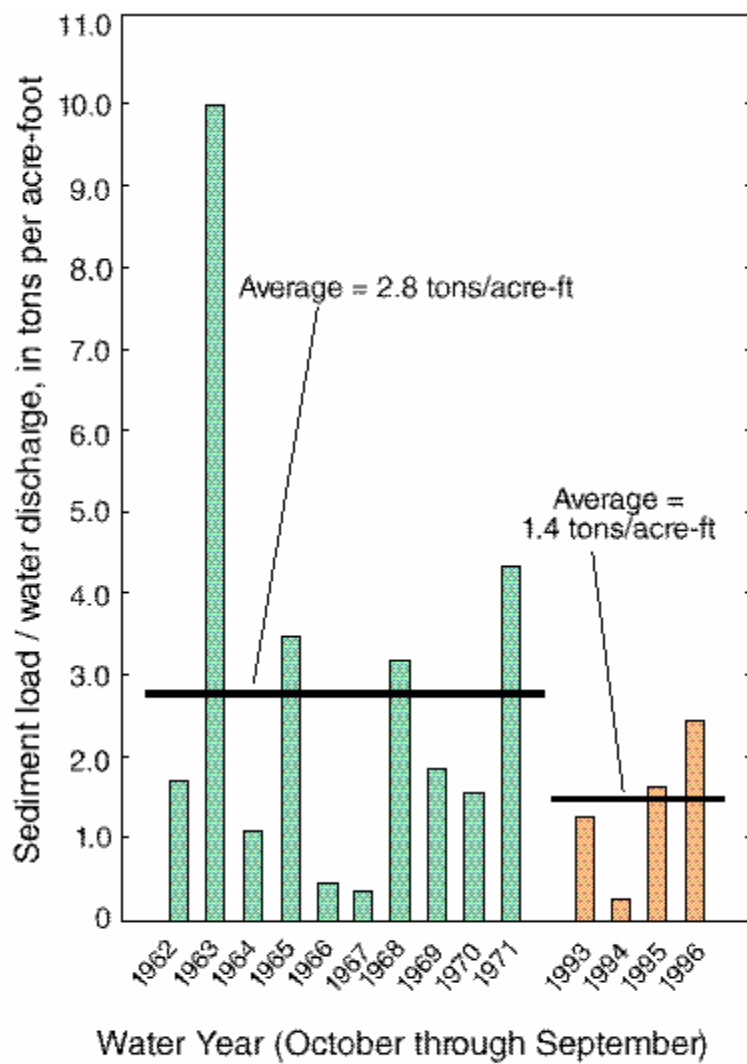


Figure 1-8. Decreasing Annual Concentration of Suspended Sediment In Palouse River Hooper Washington (USGS)

Table 1-3. Suspended Sediment and NTU levels between different land uses- agriculture and forestry.

Monitoring Site Creek	Land Use	SS ¹ max (mg/L)	SS ² ave (mg/L)	NTU ³ max	NTU ⁴ ave
Upper Big	Forest	43	16	46.8	6.13
Lower Big	Agriculture	423	320	25.8	10.57
Upper Deep	Forest	245	140	1000	49.98
Lower Deep	Agriculture	1431	1100	1000	53.49
Upper Flannigan	Forest	906	620	368	30.43
Lower Flannigan	Agriculture	1191	650	541	39.54
Upper Gold	Forest	233	130	34.6	18.95
Lower Gold	Agriculture	508	260	1000	55.62
Upper Hatter	Forest	904	600	359	28.68
Lower Hatter	Agriculture	714	270	178	23.85
Upper Rock	Forest	874	610	759	44.16
Lower Rock	Agriculture	1174	1000	450	32.8
Forest-averages totaled		3505		n.a.	29.72
Agriculture-averages totaled		n.a.	5141	n.a.	35.98

¹ SS max = Suspended sediment maximum value

² SS ave = Suspended sediment average value

³ NTU max = nephelometric turbidity unit maximum value

⁴ NTU ave = nephelometric turbidity unit average value

Vegetation

Historically, prairie grasslands, shrubs, and ponderosa forests dominated the Palouse River Subbasin landscape. The prairie grasslands were composed of Idaho fescue, blue bunch wheatgrass, and in the valley bottoms, camas root. Snowberry, serviceberry, wild rose, willows, red-osier dogwood, alder, ponderosa pine, and Douglas Hawthorn grew in the foothills. In a mosaic of age, structure, and successional classes, forested areas comprised primarily grand fir, western red cedar, western white pine, larch, and Douglas fir.

Currently, six major vegetation categories are recognized in the Palouse Range (IDFG 2001). These include cultivated fields, marshes, grasslands, brush lands, Ponderosa pine forests and mountain forests. Species are influenced by soil type, aspect, moisture, elevation, successional type, and disturbance through fire, agriculture, flooding, disease and insect outbreaks, logging, and urbanization. Dominant forest vegetation includes western white pine, larch, grand fir, Rocky Mountain Douglas Fir, Ponderosa pine, and lodgepole pine. Shrub species include willows and Rocky Mountain maple. Grass species include Idaho fescue, bluebunch, wheatgrass, and prairie junegrass.

Vegetation of the Palouse River Subbasin has been significantly altered since 1900. Mining, logging, farming, grazing, road-building, urbanization, disease, insects, and fire suppression activities have changed the forest composition from being dominated by long-lived, shade-intolerant species to forestlands dominated by short-lived, shade-tolerant species. White pine blister rust and logging activities have largely eliminated western white pine stands. Additionally, cultivated and non-cultivated dryland agriculture and grazing uses have changed the composition of native grass species on the Palouse River Subbasin prairie.

Plant communities were strongly influenced by recurrent fire, which sustained the diversity of habitats and species. This type of mosaic was before European settlement, and now this unique plant community for the most part has disappeared. Remnant native riparian bottomlands composed of native grasses and cedar groves exist in the upper Palouse River Subbasin, but they occupy a very small portion of the landscape.

Fisheries

All native species are limited to non-game fish (IDFG 2001). Historical records indicate that the only salmonid native to the Palouse River Subbasin was an isolated population of Yellowstone cutthroat trout, as Palouse Falls was an effective barrier to redband trout migration (IDFG 2001). In the last half-century, stream surveys conducted by the Clearwater National Forest (CNF), Idaho Department of Fish and Game (IDFG), DEQ and others have never documented cutthroat trout in the Palouse River Subbasin. However, a report from the St. Joe National Forest (1938) documented cutthroat in the Palouse River and several tributaries including Big Creek, Hatter Creek and Big Sand Creek. It appears that the species has been eliminated from the Palouse River System due to the changes on the Palouse River Subbasin over the last century. The IDFG considers the Palouse River Subbasin a low-priority fisheries watershed because of no native salmonid species and no anadromous fish exist in the drainage.

The following native fish may be found in the subbasin.

<u>Common Name</u>	<u>Taxonomic Nomenclature</u>
Torrent sculpin	(<i>Cottus rhotheus</i>)
Longnose dace	(<i>Rhinichthys cataractae</i>)
Speckled dace	(<i>Rhinichthys osculus</i>)
Redside Shiner	(<i>Richardsonius balteatus</i>)
Largescale sucker	(<i>Catostomus macrocheilus</i>)
Bridgelip sucker	(<i>Catostomus columbianus</i>)

The following species have been introduced in the subbasin.

<u>Common Name</u>	<u>Taxonomic Nomenclature</u>
Brook trout	(<i>Salvelinus fontinalis</i>)
Brown Trout	(<i>Salmo trutta</i>)
Rainbow trout	(<i>Oncorhynchus mykiss</i>)
Mottled sculpin	(<i>Cottus bairdi</i>)

Northern pike minnow	(<i>Ptychocheilus oregonensis</i>)
Chiselmouth	(<i>Acrocheilus alutaceus</i>)
Black crappie	(<i>Pomoxus nigromaculatus</i>)
Largemouth bass	(<i>Micropterus salmoides</i>)
Smallmouth bass	(<i>Micropterus dolomieu</i>)
Pumpkinseed sunfish	(<i>Lepomis gibbosus</i>)
Green sunfish	(<i>Lepomis cyanellus</i>)
Brown bullhead catfish	(<i>Ictalurus nebulosus</i>)

Brook Trout

Brook trout were first introduced into the Palouse River in 1936 (IDFG 2001). Subsequent stocking occurred in Big Sand Creek, Little Sand Creek, and the East Fork of Meadow Creek. Brook trout have established themselves in many tributaries as well as the mainstem Palouse River where habitat conditions and water temperatures allow their persistence.

Brown Trout

Brown trout were introduced by IDFG from 1979-1986 in the Palouse River primarily near Laird Park (IDFG 2001). Brown trout were introduced based on available habitat and water conditions to provide a sport fishery. The last brown trout sampled through various fish surveys was in 1992, in Hatter Creek. It is believed that stocking failed to establish a viable population.

Rainbow Trout

The first stocking of rainbow trout occurred in 1950 in the Palouse River (IDFG 2001). The size of rainbow trout stocked has been "catchable" size (8-12 inches) to provide trout fisherman a chance to catch the species. Evidence supports natural reproduction is occurring, as rainbow trout have been recently sampled in streams where stocking never occurred or is no longer occurring. Stocking of rainbow has varied over the years depending on egg availability.

1.3 Cultural Characteristics

The Palouse River Subbasin is a sparsely populated area with one major town, Moscow, and several other small towns and communities, including Potlatch, Princeton, and Harvard. Total population in Latah county is 34,935 (2000 census), which gives a density of 32.4 people per square mile. Agriculture, grazing, forestry, urban usages and recreational activities dominate the land use of the basin. The Palouse River Subbasin is a popular destination for outdoor recreation activities such as hunting, hiking, motorized recreation, mountain biking, camping and fishing.

History

Archeologists believe that the first humans moved into Idaho about 15,000 years ago. Originally, they came from Asia across a broad plain when the oceans were several hundred feet lower. American Indians have lived in the Palouse area for thousands of years. In the 1700s, they acquired horses, which grazed in the grassy areas of the Palouse. The Palouse was a transitional area between the Nez Perce and Coeur d'Alene tribes. The Palouse has always been important for the traditional uses of the American Indians.

The first known European people to enter the area were in the Lewis and Clark expedition in 1805. The expedition camped in the Weippe prairie and in Lewiston. Trappers arrived in the Palouse area in the early 1800s. Gold was first discovered in 1860 in Idaho, which created opportunities for other miners and settlers in the area. A few years later, gold was discovered in the Hoodoo Mountains.

Latah County was established in its current place and size in May 14, 1888, with its county seat at Moscow (Website Idaho State Homepage). The name Latah is Nez Perce and means "the place of pine trees and pestle," because the Indians found stones here suitable for pulverizing camas roots and shade under the pine trees in which to work (Website Idaho State Homepage). Idaho officially became a state in 1890, and soon homesteaders began to occupy lands in the Palouse.

Ranching/grazing, farming, logging, and mining were the main economic resources in the area. Mining, logging, farming, grazing, and urbanization have had the greatest influence on the landscape in the Palouse in past 150 years. The establishment of the University of Idaho and Washington State University in the late 1880s as land grant colleges increased the population in the Palouse.

Land Use

Today, farming, logging, grazing, and outdoor recreation are the primary land uses in this basin. There are many recreational uses as it is a popular destination spot for all kinds of outdoor activities. There are several grazing leases on public lands in the Palouse River Subbasin. The main land use in the Palouse River Subbasin is agriculture, specifically the cultivation of wheat, peas, barley, and hay. The various land uses are illustrated on Map 1-5.

Few patches of the Palouse today are covered by native vegetation. While agriculture is the most economically important feature of today's Palouse, it has had a detrimental effect on the landscape. Disturbance by farming has led to the loss of vast amounts of native plant habitat, and the remaining habitat is badly fragmented into small isolated spots separated by acres of cultivated fields (Cook and Hufford 2004). Most of the wetlands in the Palouse have been eliminated. These wetlands retained water during the wet periods and released cool ground water into the streams during the dry summer periods. Without these wetlands, rainfall and snowmelt do not infiltrate into the ground; instead they flow rapidly as overland runoff into surface waterways creating other problems such as gully, rill and instream erosion, flooding, deeply incised channels, higher peak runoffs and low summer flows.

The change in hydrology has changed the aquatic biota as well. Because of low summer flows, reduced shade and loss of channel diversity, aquatic organisms such as fish and insects have been removed or permanently altered. The only native salmonid, the cutthroat trout, has been eliminated from the Palouse drainage. Because of the extensive farming in the Palouse region, there are very few places where undisturbed native plant communities exist today. Much of the native fauna have been removed or have relocated to isolated sections of the subbasin, and some species are on the verge of extinction.

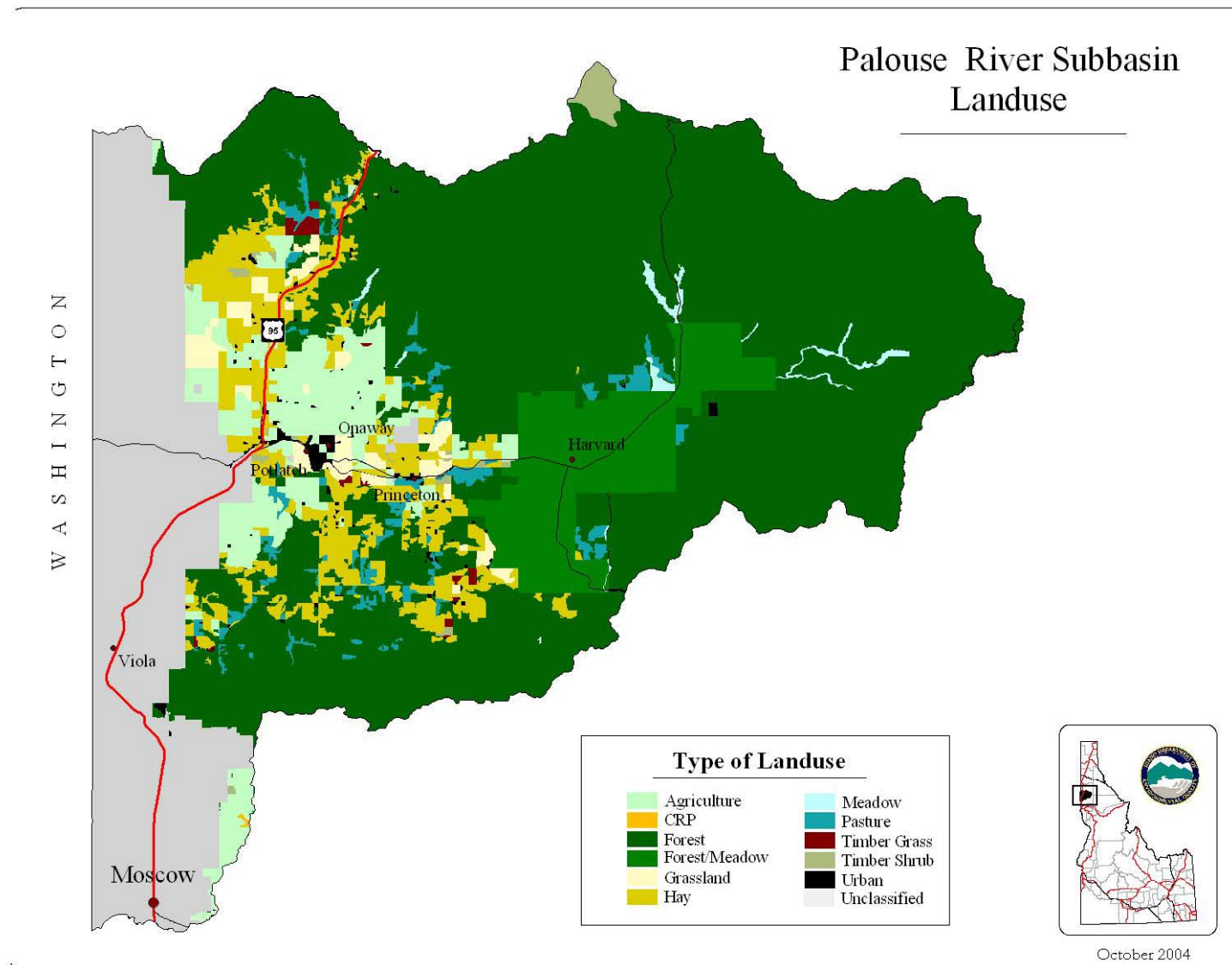
Agriculture

The Palouse prairie is one of most productive agricultural areas in the world due to the fertile soils and winter and spring rainfall. In the 1860s, the first European settlers used the Palouse hills as pastures but soon discovered the soil's fertility and planted grain on the dry meadows and lower-side slopes. The opening of the railroad in the Palouse just after the turn of the twentieth century had a major impact on the Palouse as agricultural goods, equipment, and supplies were easily transported into the area. Wheat and other cereals were planted and adapted well to the hillsides and climate of the Palouse (Black et al. 1998). These crops were shipped to other markets. Horse and mule teams worked the land in the early 1900s. Machinery soon began to change farming, and by 1930, 90% of the Palouse wheat was harvested using combines (Black et al. 1998). Fertilizers were introduced after World War II and increased crop production 200%-400% (Black et al. 1998). During this time frame federal agricultural programs encouraged farmers to drain seasonal wet areas. In less than 100 years small family farms have mostly disappeared as technology has allowed farmers to cultivate more acres of land more efficiently.

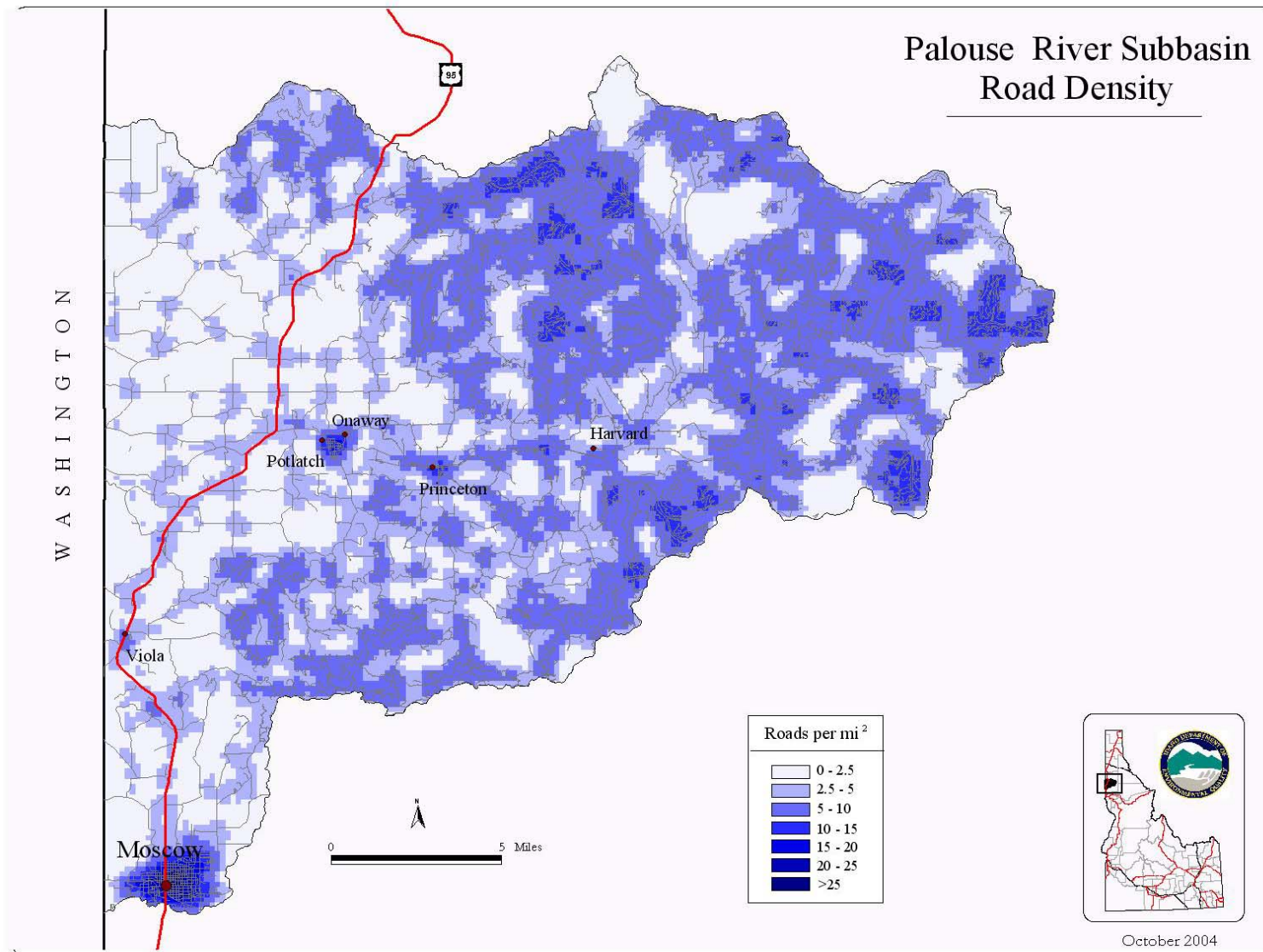
In the last few decades some highly erodible lands have been removed from crop production under the Federal Conservation Reserve Program (CRP) In Latah county about 54 square miles (34, 600 acres) have been placed in CRP land (Black et al. 1998.). Additionally six square miles (3852 acres) have been included into the Idaho Fish and Game Department's Habitat Improvement Program. This program converts cropland to ponds and native plantings (Black et al. 1998). Wheat, barley, peas, and lentils from this area are exported all over the globe.

Forestry

Originally, logging began in the 1880s to clear land and provide wood for homes. However, it was soon recognized that logging could also provide a good source of income. The major logging boom began in 1905 with the creation the Potlatch mill and the town of Potlatch. The mill remained in existence until 1980, with the most productive decades being the 1960s and 1970s (Table 1-4). Due to this reduction in logging, the town of Potlatch is much smaller today and more a farming community than a mill town. Although greatly reduced, logging is still important to the economies of the Palouse. Bennett Lumber Products Inc. and Potlatch Corporation Inc. still manage several thousand acres in the Palouse primarily for silviculture activities. The CNF and the Idaho Department of Lands (IDL) also manage thousands of acres in the Palouse for silviculture and recreational activities.



Map 1-5. Land use in the Palouse River Subbasin.



Map 1-6. Road Density in the Palouse River Subbasin.

Table 1-4. Timber harvest by decade in millions of board feet from CNF land.

Decade	Millions of Board Feet Harvested
1930s	40
1940s	51
1950s	173
1960s	726
1970s	694
1980s	318
1990s	228

Recreation

Recreational activities include fishing, hunting, camping, snowmobiling, cross country skiing, four-wheeling, canoeing, swimming, mountain biking, berry picking, mushroom hunting, wildlife and scenery viewing, trapping, motorcycling, hiking, photography, and sight-seeing historical areas of interest. Camping, fishing, and off-road vehicle usage are probably the most popular recreational activities in the area. These activities provide economic support to Moscow, Potlatch, and the surrounding communities of Troy, Deary, and St. Maries. The CNF maintains several campgrounds and many other unofficial campgrounds. Other unofficial campsites are located on IDL, Bennett Lumber, and Potlatch Corporation lands.

Livestock and Grazing

Small fenced pastures are prevalent in all of the §303(d) watersheds, although Flannigan Creek, Hatter Creek, and Deep Creek have the most pasture activity. Some of these fields receive heavy use, especially when the livestock are allowed to graze an area until there is no vegetation left. In addition several animal feeding operations (AFOs) exist. These AFOs are used primarily for winter feeding and calving of livestock that graze in other areas during the rest of the season.

Within some of these pastures are perennial or intermittent streams. In these locations, negative impacts to water quality can directly occur when livestock come to the water or the riparian areas to drink or stay cool. Impacts include destruction or removal of riparian vegetation, increased sedimentation levels to the streams, and fecal material deposition in or near waterways. Pastures not located within stream riparian areas can impact water quality as well; rain and snowmelt run-off can transport material from a pasture to a stream channel through ephemeral drainages.

IDL, Potlatch Corporation, and the Clearwater National Forest have a cooperative agreement regarding grazing allotments on their lands. Information from IDL shows that open-range grazing of cattle does occur in portions of the Palouse River Subbasin. Like fenced pastures,

impacts from open grazing include destruction or removal of riparian vegetation, increased sedimentation levels to the streams, and fecal material deposition in or near waterways.

An Animal Unit Month (AUM) is the unit of measurement for cattle in these allotments. An AUM equals the amount of forage necessary to feed one cow and her calf for one month. The following allotments are located within the Palouse River Subbasin:

- 1) Sec 16, T42N, R3W, 29 AUM (Big Creek Watershed)
- 2) Sec 24, T41N, R5W, 110 AUM (Flannigan Creek Watershed)

Because fencing is limited on open-range grazing lands, cattle can move from one area to another, roaming from watershed to watershed. The above leases are required to have full-time livestock herders, and salt and minerals placement within 600 feet from major streams is prohibited. The ideal is that herders and salt and mineral placement encourages cattle to spend less time in the riparian areas.

Mining

Historically, mining played a major role in shaping the economy and changing the landscape in the subbasin. Many features on the landscape were named after mining, such as Gold Creek, Gold Hill, and Mica Mountain. Mining began back in the 1860s and continued through 1912 (CNF 1988). During the great depression, miners tried their luck again in the Palouse Drainage. Gold Creek, Crane Creek and other non-§303(d)-listed streams and their tributaries were placer-mined by hand, dredges, and other large machinery. In 1940, a large mining company began a massive river dredging operation on the North Fork Palouse and Palouse Rivers. The operation only lasted a few years, but the effects from that operation can still be seen today, especially on the lower miles of the North Fork Palouse River.

Today, there is a very limited amount of mining activity in the Palouse River Subbasin. Historically, in Latah County at least, nine mining districts were created, although none are active today. Current recreational dredge mining may occur in limited areas in the subbasin, but the impacts to water quality appear to be minimal. Currently, there are no permitted mining activities in the subbasin. There are several quarries within the Palouse River Subbasin that are actively mined for gravel, however.

Transportation

All of the §303(d) streams are affected to some degree by roads. Map 1-6 is a map of the road density in the Palouse River Subbasin.

In the late 1800s and early 1900s, railroads were the primary transportation system in the area, bringing people and supplies into Idaho. Supplies were brought in and out of the Palouse to support the agriculture, timber, and mining industries. Today, highways, barges, and airfreight have replaced the railways for transporting supplies in the Palouse. Old grades and tresses remain in some areas in the Palouse River Subbasin. Some of these abandoned

railroad lines have massive fill slopes, which have the potential for large mass failures and should be removed if possible.

Land Ownership, Cultural Features and Population

The Palouse River Subbasin is under three primary landowner types: federal lands, state lands, and private lands. Major land owners include the state of Idaho, CNF, Potlatch Corporation, and Bennett Lumber Products. Table 1-5 displays approximate land ownership percentages and Map 1-7 shows the locations in the drainage. Most of the basin is either dryland agriculture or managed for timber production.

Population in Latah County is 34,935 (2000 census); however, most of the county's population live within the town of Moscow, which has a population of 21,291 people (2000 census). Population in the subbasin continues to grow, and many of the agricultural lands are being parceled into lots for homes. Agriculture continues to be the main source of income while the timber industry has decreased over the past few decades. The University of Idaho, Bennett Lumber Products, Wal-mart, Gritman Medical Center, and the public school districts are the major employers in Latah County. Population trends for Latah County and the cities of Moscow and Potlatch are displayed in Table 1-6.

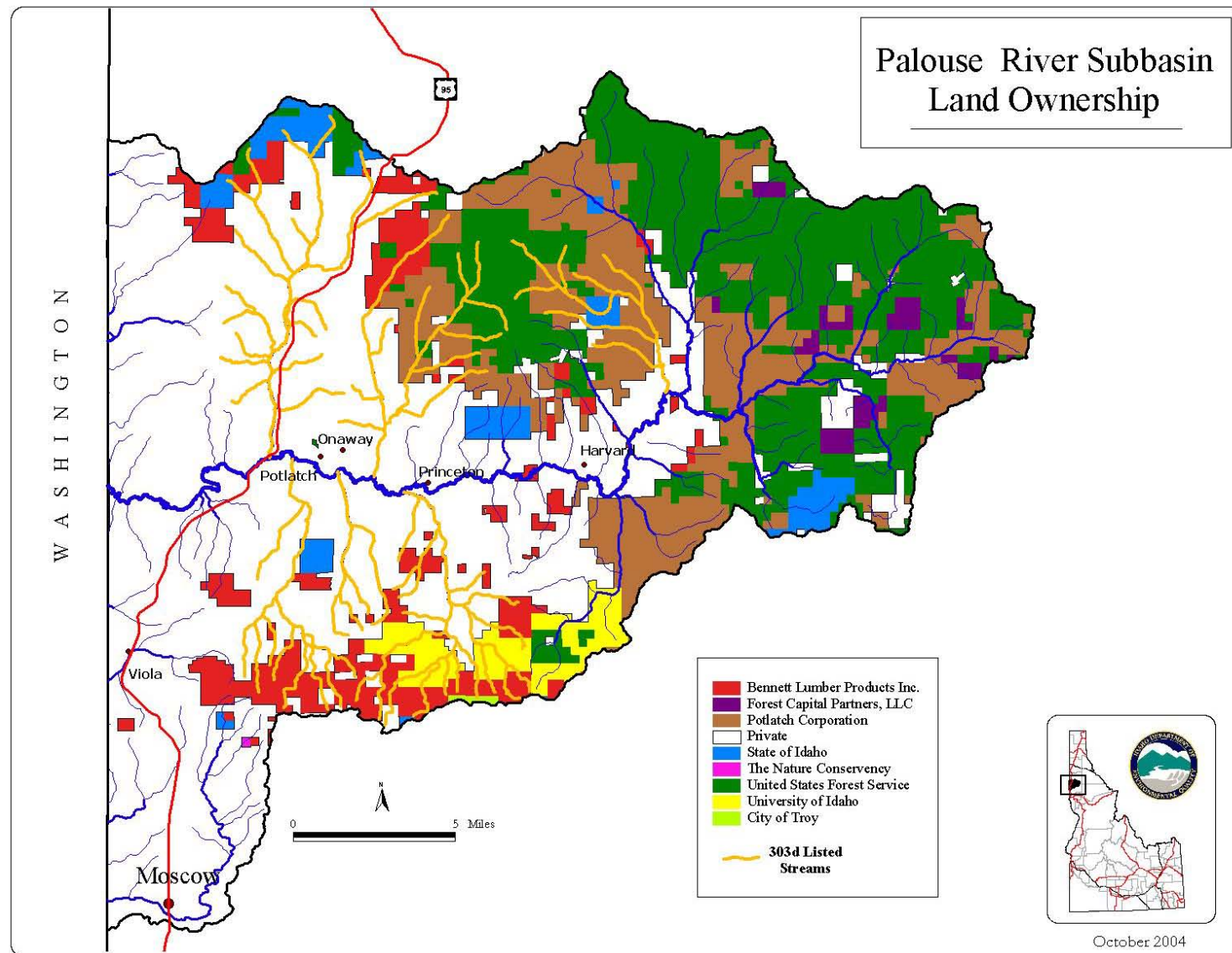
Table 1-5. Land ownership of the Palouse River Subbasin.

Ownership	Percentage
Private land ownership- non industry	52.1%
National Forest Lands (USFS)	20.0%
Potlatch Corporation	14.8%
Bennett Lumber Products Inc.	6.8%
State of Idaho (IDL)	2.7%
University of Idaho	2.4%
Forest Capital Partners	1.2%
City of Troy	< 0.1%
Nature Conservancy	< 0.1%
Water	< 0.1%

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Table 1-6. Population trends.

City/County	1880	1890	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Moscow	ND	ND	2484	3670	3956	4476	6014	10,593	11,183	14,146	16,513	18,398	21,291
Potlatch	ND	ND	ND	2055	ND	ND	ND	819	880	871	819	790	791
Lewiston	739	849	2425	6043	6574	9403	10,548	12,985	12,691	26,068	27,986	28,082	30,904
Latah County	ND	9173	13,451	18,818	18,092	17,798	18,804	20,971	21,170	24,898	28,749	30,617	34,935



Map 1-7. Land Ownership

Economy

Today, the economy of the Palouse is dominated by agriculture and two universities: the University of Idaho and Washington State University. Historically, the economy of the basin was first dominated by mining activities. As miners and other settlers arrived in the area, they took advantage of the grasslands for grazing livestock. The soil proved to be very fertile as wheat, barley, peas and other dryland crops flourished. Several mills were also built, and the town of Potlatch was established by Potlatch Corporation in 1905. Some logs were transported down the Palouse River to mills, while others were hauled by horse to the mills. In the 1880s, the railroads had reached the Palouse, allowing for wheat, barley, oats, straw, peas, timber, and fruit to be transported to other markets.

In addition the agriculture and the universities, forestry, livestock, grazing, construction, and recreation are other major economic factors in the Palouse River Subbasin. All of these affect water quality to some degree. Although the amount of timber removal on U.S. Forest Service (USFS) lands has decreased significantly, state and private lands have been able to maintain a modest harvest to keep some of the local mills in business. Some mills have been able to cut back or make adjustments while others were no longer able to make a profit and have closed as a result. The surrounding landscape provides good fishing, hunting, and other outdoor recreation opportunities that help the local economy to a lesser degree than agriculture, forestry, and construction. Agriculture is and will continue to be the dominant economic driving force in the Palouse. Preventing the rich, fertile soil of the Palouse from eroding is the major theme for this document. This theme, not only improves and maintains high water quality, but it also is the economic life force of the Palouse.

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